bio, provides better cosmosis and decreased morbidity for pediatric cardiac surgery. This report reviews a 16 year experience with ASD repair through a right sided, minimally invasive thoracotomy (MIT).

Methods: From 4/81 through 3/97, 85 pts underwent MIT repair of ASD: 80 pts had secundum ASD, 1 had scimitar syndrome, 1 had sinus venosus defect and 3 had ostium primum defects. This technique has been used exclusively for ASD repair since 1995. The mean age was 9.3 yrs (range 1–41). A 5–9 cm long skin incision was made in the right inframammary skin fold, entering the chest through the 4th intercostal space. All pts underwent ascending aortic cannulation and bicaval venous cannulation, with standard perfusion and moderate hypothermia (30–32 °C). Seventy-five pts (88%) received antegrade cardioplegia, 9 pts (11%) underwent fibrillatory arrest, and 1 pt (1%) with scimitar syndrome had hypothermic circulatory arrest. The cross clamp time was 20 ± 12 min (mean ± SD) and the bypass time was 38 ± 18 min.

Results: There were no hospital deaths, neurologic complications or wound infections. Operative exposure was excellent in all pts and conversion to sternotomy was not required. The mean postoperative hospital stay was 4.2 ± 1.4 days. Late follow-up revealed an excellent cosmetic result, with normal breast and chest wall development in every pt.

Conclusions: This 16 yr experience demonstrates the uniform safety and reproducibility of a MIT approach for ASD repair. This technique offers a superior cosmetic result with limited morbidity and a zero percent operative mortality. Minimally invasive thoracotomy is the preferred approach for ASD repair and is the benchmark against which catheter based device closure must be compared.

11:00

841-3 Long Term Outcome of Surgery for Anomalous Origin of the Left Coronary Artery From the Pulmonary Artery: A Twenty-Four Year Experience

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Introduction: Few long term data of the results of surgical management of anomalous origin of the left coronary artery from the pulmonary artery are available in the literature.

Methods: Thirty four patients with a left main coronary artery arising from the pulmonary artery as an isolated lesion were operated on between 1973 and 1997. Ages ranged from 2 weeks to 9 years. Twenty seven patients (79%) underwent implantation of the left main coronary artery into the ascending aorta and 7 patients (21%) had a Takeuchi procedure.

Results: Follow-up ranged from 2 months to 24 years. Five of the thirty four patients died (mortality 14.7%). Four of the five deaths occurred before the availability of assist device systems, with only one death in the last 14 years. Of 29 survivors, 25 (86%) have improved NYHA class on long term follow-up. Three of four patients with poor results and a worse NYHA class had undergone a Takeuchi procedure. All patients were followed by echocardiography. Left ventricular function improved to near normal levels in 25 patients within six months of repair. Mitral incompetence was seen preoperatively in 26 patients, and recovered within six months in all but one survivor. Postoperative mechanical support has been used for left ventricular failure in four patients, with three survivors.

Conclusions: 1. There is excellent long term functional outcome from direct aortocoronary connection for this condition. 2. Takeuchi procedure has a high incidence of late supravalvar pulmonary stenosis. 3. Mechanical support in the early postoperative period could avoid mortality from left ventricular failure. 4. Mitral incompetence and left ventricular function recover rapidly after aorto-coronary connection.

11:15

841-4 Ventricular Septal Defect Patch Fenestration in Repair of Tetralogy of Fallot With Diminutive Pulmonary Arteries

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Background: Repair of tetralogy of Fallot (TOF) with diminutive pulmonary arteries (PAs) can lead to suprasystemic right ventricular pressure (RVp), low cardiac output and death. Staged repair with ventricular septal defect (VSD) patch fenestration may prevent post- operative demise, promote PA growth and allow for subsequent fenestration closure. The results of such an approach are unreported.

Methods: Data were examined retrospectively for all patients with TOF who had a fenestrated VSD patch at our institution.

Results: Between 1/85 and 6/97, 24 patients undergoing repair of TOF had fenestration of the VSD patch - 13 at initial bypass and 11 immediately post bypass for suprasystemic RVp. Median age 6.2 yrs (1–30). Median Nakata index 101 mm^2/m^2 (51–180). There were 2 early deaths, 1 from low cardiac output and 1 from a misdirected RV-PA conduit. Postoperatively, 2 patients had ≤2/3 systemic RVp, while 20 had near-systemic RVp. Median arterial saturation was 90% (80–98). No patient had excessive left to right shunt. Mean follow up was 43 ± 41 mo. The fenestration closed spontaneously in 7, was closed as part of a subsequent operation in 3, and with a transcatheter double umbrella device in 4. In 8, the fenestration is open (median subgroup follow up 4 mo (0–22)). There was one late (sudden) death. Since VSD surgery, 18 of 22 survivors had PA dilations and 6 had reoperations (conduit change 2, unifocalization 2, PA plasty 1, residual patch margin VSD 1). At latest follow up, the RV/LV pressure is 0.8 ± 0.2 and the arterial saturation is 95% (86–100).

Conclusions: The data suggest that planned fenestration of the VSD patch in repair of TOF with diminutive pulmonary arteries may be beneficial. In many, the VSD will either close spontaneously or can be closed in the catheterization lab.

11:30

841-5 The Current Risk Factors of Fontan-type Procedures and the Strategy of Palliation in Fontan Candidates

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Background: We have been extending the indication of Fontan-type procedures (F) to those who have pulmonary artery (PA) distortion, atrioventricular (AV) valve regurgitation, anomalous venous return, or supraventricular (SV) tachyarrhythmia by additional simultaneous surgical interventions. The current risk factors for F were evaluated.

Methods: Records of 1 68 consecutive patients who had F for various anomalies at our unit between 1985 and 1996 were reviewed. Preoperative risk factors for hospital deaths (HD, 23 cases, 7.5%) were analyzed using stepwise logistic regression. The appendage-to-PA direct anastomosis with oblique partition of the atrium was the standard procedure, and extensive PA angioplasty (85 cases), AV valve plasty (148), surgical ablation and AV node modification (41), cavopulmonary anastomosis (99), and correction of anomalous pulmonary venous return (21) were simultaneously performed when necessary.

Results: Lower pulmonary blood flow (Qp), larger ventricular end-diastolic volume (VEDV), presence of anomalous pulmonary venous return, and longer cardiopulmonary bypass time were identified as significant ($p < 0.05$) risk factors. PA distortion, AV valve regurgitation, SV tachyarrhythmia, anomalous systemic venous return, pulmonary vascular resistance (0.26 to 4.4 units), PA index (175 to 1040), PA pressure (5 to 36 mmHg), ventricular ejection fraction (0.36 to 0.76), age (1.2 to 32 years) did not have significant impact on HD within the ranges. The regression equation showed a consistent decrease in HD with an increase in Qp even with an expected increase in VEDV by the increase in Qp taken into account.

Conclusions: PA distortion, AV valve regurgitation, anomalous systemic venous return, and SV tachyarrhythmia are surgically correctable, and therefore are not the risk factors. As palliation for F, correction of PV anomaly, and a shunt that gives good Qp is important considering development of pulmonary vascular bed in F candidates with decreased pulmonary blood flow, and early F is recommended before excessive increase in VEDV occurs with deterioration of ventricular function.

11:45

841-6 Completion Fontan Without the Use of Cardiopulmonary Bypass

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Direct cavopulmonary connection using an extracardiac conduit has theoretical advantages in the management of children with single ventricles. Completion Fontan using an extracardiac conduit may be accomplished without cardiopulmonary bypass (CPB). Experience with the first 15 consecutive patients is reported. From January 1995 to July 1997, 15 patients had an extracardiac IVC to pulmonary artery conduit constructed without the use of CPB. 11 of these 15 patients had hypoplastic left heart syndrome while the remaining had tricuspid atresia. Average age was 24 months, from 18–34 months. Average weight was 11 kg, from 8.6–12.4 kg. Risk factors include, elevated pulmonary vascular resistance in one patient with hypoplastic left pulmonary artery, at least moderate AV valve regurgitation in 3 patients. An IVC to atrial shunt was used during construction of the cavopulmonary connection. A single 4-mm fenestration was used. Postoperatively, there were no mortalities. One patient with hypoplastic left heart syndrome and moderate tricuspid valve regurgitation required resuscitation for ventricular dysrhythmia. Complications in others include one mediastinitis, and superficial wound infection in a second. Pleural effusions persisted in 2 of 15 patients two weeks after surgery. Excluding the one patient who had digoxin related ventricular dysrhythmia, the average ICU stay was 3 days (1–6); length of hospital stay was 13 days (4–38); average ventilator hours were 14 hours following